Ice Accumulation Reference - Forecasting

Freezing Rain Accumulation Model (FRAM)

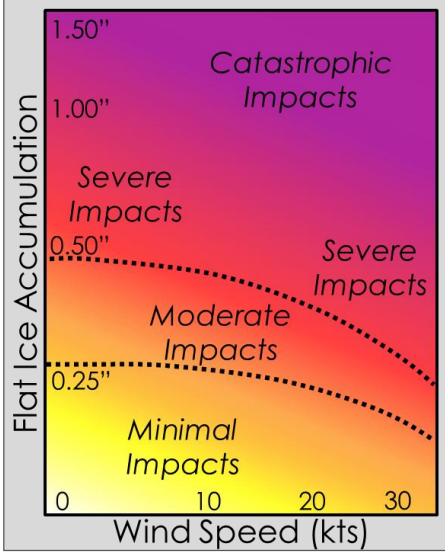
Not all rain freezes immediately on contact! Ice:Liquid Ratio (ILR) can be predicted with skill through evaluation of precipitation rate, wind speed, and wet-bulb temperature. The FRAM (Sanders and Barjenbruch, 2016) predicts freezing rain amounts using this technique.

Precipitation rate (hourly) is the most significant factor in accurately predicting ice amounts.

Available in Forecast Builder or via the VLAB SCP as the Freezing Rain Accumulation Tool (FRAT)

Ice Impacts & Warning Guidance

Ice Storm impacts are not solely dependent on ice accumulation amounts. Wind plays an important role! Other things like time of year, tree type, and mitigation efforts may also play a role. This chart (for internal use only) APPROXIMATES the relationship of wind and ice. Flat ice accumulation > 0.50" often results in ice storm impacts but amount between 0.25" – 0.50" depend more on wind speeds.



Freezing Rain Prediction Tips

Increasing precipitation rate leads to more liquid runoff.

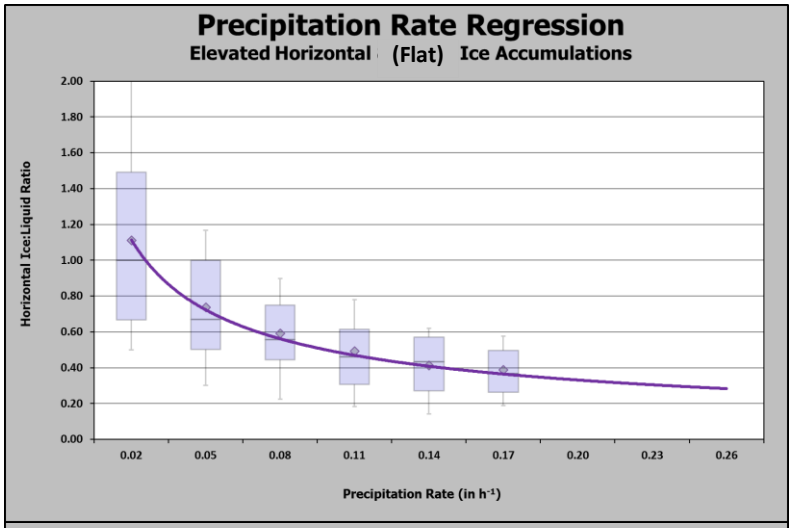
Increasing wind speed replaces air warmed by latent heat release, increases horizontal moisture flux, and promotes evaporational cooling...all leading to more efficient icing.

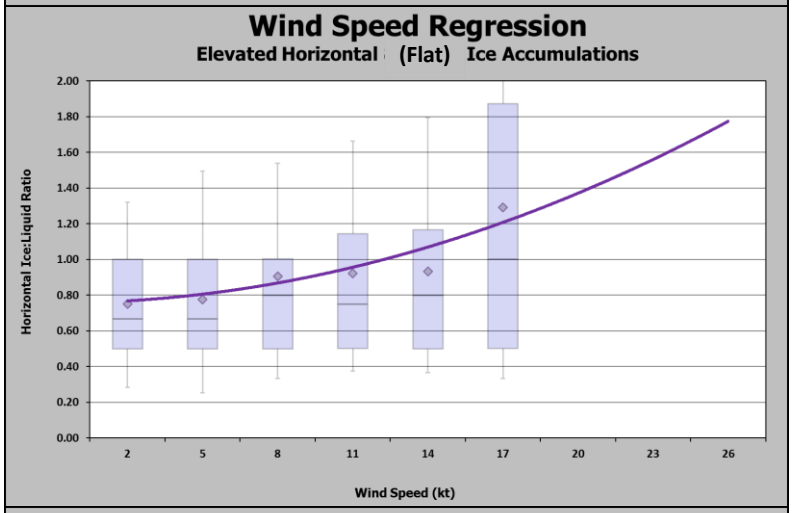
Freezing drizzle often results in greater ILR, especially in wind-driven drizzle. 3:1 is possible.

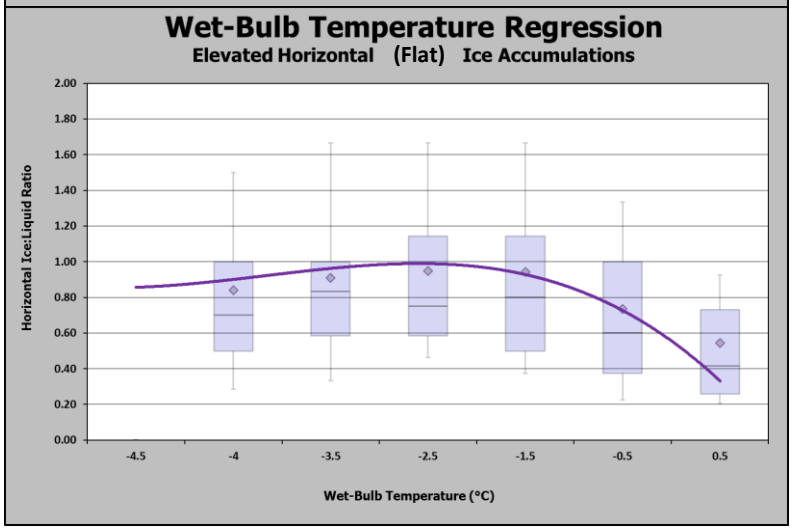
Ice accretion is possible with T ≥ 32 if Tw ≤ 32.

Accurate <u>hourly</u> T, Td, Wind, QPF, and Wx are key to a successful IceAccum forecast.

Ice accumulation on roads is more complex, tied to ground temperatures and treatment methods. FRAM may not apply.







Ice Accumulation Reference – Situational Forecast

Why is the IceAccum greater than QPF? Is this OK?

YES. FRAM will output IceAccum > QPF at times. YES it is intentional. YES it is science-based.
FRAM will typically perform very well over the course of an event, but…

The FRAM output is a statistical best forecast. There are situations for which the forecaster can and should collaborate, coordinate, and adjust the IceAccum output from the FRAM and Forecast Builder. This page has multiple situational examples to consider.

Why can ice actually accumulate greater than liquid?

Wind: In the real world, wind is the most common reason that ice can accumulate greater than the actual rain fall.

When there is a wind, liquid does not just fall vertically, but also moves horizontally. The horizontal motion increases with greater wind speed. More horizontal motion results in a higher likelihood for a drop to contact an elevated surface (branch/wire) and freeze.

QPF: In GFE and Forecast Builder, low hourly QPF is the most common reason for IceAccum output to be greater than QPF. Sometimes this is a good forecast, and sometimes it is an artifact of the process which the forecaster can improve upon (see situations below).

An existing hindrance of our forecast process is that QPF defaults to a 6-hour grid duration. If the forecaster can collaborate and coordinate a great forecast with a smaller time step, the IceAccum forecast will almost always benefit.

Freezing Drizzle & Wind < 5 kts

FRAM will perform "pretty well". FRAM may over-forecast for very light QPF < 0.01 /hr.

- Small droplets (drizzle) are very efficient accumulators.
- Supercooled droplets (drizzle) are very efficient accumulators.
- Expect IceAccum > QPF
- Expect ILR between 1.1:1 and 2:1
- With any breeze, rain gauges will under-catch, underestimating liquid amounts.

Very Light Freezing Rain & Wind < 12 kts

FRAM may over-forecast, especially for very light QPF < 0.01"/hr or Tw ≥ 31 F.

- Large droplets are not very efficient accumulators – better chance for runoff.
- Warm rain drops (falling through a melting layer) are not very efficient accumulators.
- Very little horizontal motion of larger drops.
- Expect IceAccum ≤ QPF
- Expect ILR < 1:1

Freezing Drizzle & Wind > 15 kts

FRAM will very likely under-forecast IceAccum. Consider increasing amounts.

- Small droplets (drizzle) are very efficient accumulators and easily blown horizontally.
- Supercooled droplets (drizzle) are very efficient accumulators.
- Expect IceAccum >>> QPF
- Expect ILR between 2:1 and 5:1 (greater with greater wind speed.
- With any breeze, rain gauges will under-catch, underestimating liquid amounts.

Freezing Rain & Tw ≥ 31 F & Wind < 12 kts

FRAM may over-forecast, especially for heavier QPF > 0.05" /hr with light wind.

- Large droplets are not very efficient accumulators – better chance for runoff.
- Warm rain drops (falling through a melting layer) are not very efficient accumulators.
- Heavier precip rates give less time for freezing, resulting in more runoff.
- Very little horizontal motion of larger drops.
- Little wind to transport heat away from drop
- Expect IceAccum <<< QPF
- Expect ILR between 0.2:1 and 0.7:1